Dry Pea Production in Saskatchewan

Market Opportunities | Adaptation | Seedbed Preparation and Seeding | Inoculation | Varieties | Weed Control Practices | Insect Pests | Disease Prevention | Harvesting | Information Sources |

Last Update: October 1994

The pea was among the first crops cultivated by man and was first domesticated in the Near East. It is a cool season crop and is widely grown in the cooler temperate zones of the world. The dry pea is grown on about 9 million ha annually and total production exceeds 10 million t. China and Russia each produce about one-third of the world dry pea crop.

The pea was a leading crop in Canada at the turn of the century, with Ontario averaging 288,000 ha for the 20-year period, 1883-1902. However, by 1980 only 50,000 ha of the dry pea were grown in Canada, primarily in the 3 prairie provinces, where the average yield was about 1,800 kg/ha (1,600 lb/ac).

The dry pea was grown on over 450,000 ha in Saskatchewan in 1994, a large increase from the 300 ha reported in 1967. The average yield in Saskatchewan is about 1,800 kg/ha. However, higher yields may be obtained if proper agronomic practices are followed.

Market Opportunities

World exports of the dry edible pea have averaged about 300,000t annually in recent years. Approximately one-half of these exports were from North America. Canada's share of the export trade has been variable, but has averaged about 25 percent. Major importers have been Colombia, Cuba, Trinidad, India, Venezuela, and the United Kingdom. A large market in the European Economic Community has developed in 1986 for "feed" peas used as livestock protein supplement. Canada has exported 400,000 to 500,000 t to the European feed market in recent years.

The dry pea is widely used for human food and livestock feed. Only a small part of Canada's dry pea crop is used domestically for human food such as pea soup. The balance is exported or used for livestock feed or seed. Research by the Animal and Poultry Science Department, University of Saskatchewan, has shown that a ground pea-barley mixture (40 percent peas with a 22.5 percent protein content) with iodized salt and a mineral- vitamin premix resulted in a 16 percent protein grower-finisher ration suitable for hogs. Recent feeding studies indicate use of feed pea alone and in combination with canola meal provides and excellent protein source for grower-finisher hog rations.

A relatively high proportion of the pea crop (10 to 12 percent) is required for seed. This is due to the high seeding rate required to produce a satisfactory stand of this large-seeded crop.

Research by the Plant Biotechnology Institute of the National Research Council has resulted in the development of a process for milling dry pea seeds into hulls, flour, pea protein concentrate, and pea starch. A continuing research program at the University of Saskatchewan involves development of new uses for these pea products. Some of the more promising uses developed for pea starch are in the purification of potash and in the manufacture of carbonless carbon paper. Some pea splitting is done in the edible market. This process adds value to the product before is is shipped to the buyer.

Producers are advised to seedk information on contracts for marketing their pea crops, unless the crop is for their own seed or feed production. Several firms offer contracts, generally specifying a minimum guaranteed price. Most firms will supply seed on credit, if desired.

Table of Contents

Adaptation

The dry pea is a cool season crop with a restricted root system and cannot tolerate hot weather or drought stress during flowering. Accordingly, it is best adapted to the Black soil zone. Poorly drained, cold soils should be avoided, as they favor the development of seedling diseases and root rots. The pea crop should not be grown on salt-affected soils. Well-drained, clay loam soils are ideal for pea production.

Dry pea should not be grown on the same field more than once every 4 to 5 years because of the danger of a rapid increase in soil-borne diseases.

The pea plant is capable of fixing part of its nitrogen requirement if properly inoculated with the pea strain of *Rhizobium* (see "Inoculation"). Thus, acceptable pea yields can be produced in some years with little nitrogen fertilizer. A soild test should be used to determine reuired nutrients. In addition, crops following the pea crop in the rotation generally yield higher than crops grown after cereals, flax, or canola. For these reasons, pea production provides an agronomically sound way of extending and improving crop rotations.

Seedbed Preparation and Seeding

Firm, weed-free seedbeds on high-fertility soils are best for pea production. Stony fields should be avoided or rolled after seeding to bury loose stones that otherwise might be picked up in swathing and harvesting. Cultivate the land to seeding depth prior to seeding, as this helps warm the soil and favors rapid germination.

Plant the pea seeds 3 to 8 cm deep in rows 15 cm apart as early in the spring as feasible, provided the temperature of the surface 3 cm of soil is above 5 degrees Celcius and the soil is not excessively wet. Early seeding advances maturity of the crop, so that the probability of detrimental high temperatures during flowering is reduced. Pea seedlings can withstand considerable frost. Even if the frost is severe enough to kill the main shoot, the pea plant will initiate regrowth from buds at one of the nodes at or below the soil surface, with a resulting delay in maturity. Early seeding, in general, results in higher yields, but protein content may be slightly lower.

Seed can be done with an air seeder, grain drill, or discer. If the discer is used, the soil should be packed after seeding to prevent excess moisture loss from the loose soil. Care must be taken to adjust the seeder to prevent cracking of the seed, especially of the large-seeded varieties, since cracked seed will not germinate. Care must be taken not to pack or roll immediately after seeding if soild moistue is high.

Seeding rate depends on seed size of the variety. The optimum seeding rate is about 12 seeds per m of row in rows 15 cm apart. This averages about 125 kg/ha (110 lb/ac) for small-seeded varieties such as Trapper, 175 kg/ha (155 lb/ac) for Radley and Victoria and 190 kg/ha (170 lb/ac for large-seeded varieties such as Century and Express.

Some producers seed barley, oat, mustard, or canola at reduced rates in their pea crop to reduce lodging and facilitate swathing. However, pea plants are poor competitors and yield of the pea component will be reduced.

Table of Contents

Inoculation

Legume crops are able to take much of their nitrogen (N) requirement from the atmosphere by forming a symbiotic association with soil bacteria called **Rhizobium**. These bacteria colonize the legume roots in structures called nodules and fix nitrogen for the legume. In order for nitrogen fixing to occur, the seed must be inoculated immediately before seeding with proper strain of bacteria specific to dry pea. The use of a sticker such as a syrup or powdered milk solution will ensure the inoculant sticks to the seed. Some inoculants are produced with self adhesives.

It is common to observe lower levels of nodule formation in fields with no previous history of inoculation of the same crop. Soil and weather conditions can also affect the level of successful colonization. Cool, dry soils are detrimental to the process. **Read and follow inoculant lable directions.**

High soil nitrogen levels (over 60 kg N/ha) inhibit N fixation since the legume plant will preferentially use the soil nitrogen rather than fix nitrogen. If dry pea has never been grown in a field before, and the soil test N level is less than 30 kg N/ha, the producer should apply 30 kg N/ha prior to seeding as a precaution against an inadequate supply of N, and resulting low yields.

Rhizobium bacteria can live in the soil for a number of years. However, the most efficient nitrogen fixing bacteria may not be among those that survive. For this reason, most experienced legume producers inoculate every year.

Varieties

Many registered dry pea varieties are adapted to Saskatchewan. The publication *Varieties of Grain Crops for Saskatchewan* compares varieties of dry pea. The FarmFacts publication *Pea Varieties for Saskatchewan* provides details on registered dry pea varieties. Some common varieties are:

Century - Licensed in 1960: Seeds are much larger than Trapper, and about the same yield and maturity.

Trapper - Registered in 1970: A small-seeded variety. Trapper matures in 95 to 100 days. Trapper has the advantage of smaller seeds (reduced cost of establishment) and less vine growth (reduced problems with vines and foliage diseases) than Century.

Victoria - Registered in 1984: Seeds are intermediate in size between Century and trapper. Victoria matures several days earlier than Trapper, but has shorter vines and is higher yielding.

Titan - Registered in 1985: Possible replacement for Century, as it is about 10% higher yielding.

Express - Registered in 1986: Early, high yielding, large seed size and shortened internodes. Express has a fragile seed coat and is extremely susceptible to mechanical damage, especially if seed moisture content is below 14% (see Harvesting section).

Radley - Registered in 1990: A semi-leafless, green cotyledon pea, well adapted to high moisture areas.

Pedigreed Seed and Food Pea Premiums

Food pea varieties grading No.1 Canada or No. 2 Canada often command a premium over feed pea. No. 1 Canada Yellow Pea grade allows a maximum of 1.0% seed of other Colours and No. 2 Canada Yellow Pea allows a maximum of 2.0% seed of other Colours. However, No. 1 Canada Green Pea allows a maximum of 0.5% seed of other Classes and No. 2 Canada Green Pea allows a maximum of 1% seed of other Classes. Thus, it is more difficult to produce food grade green than food grade yellow pea. This emphasizes the importance of using pedigreed seed, with its high standards of purity, in the production of food grade pea.

Semi-leafless Growth Habit

Some pea varieties have a semi-leafless growth habit. Their leaflets are converted to tendrils, The tendrils of adjacent plants intertwine to provide better support (standability) for the entire canopy. This characteristic can ease harvest under good growing conditions. The canopy of semi-leafless varieties maybe less competitive to weeds. It is important to establish a uniform heavy stand for semi-leafless types.

The semi-leafless varieties are often better suited to areas of high moisture in part due to their shorter vine length and more open canopy.

Table of Contents

Weed Control Practices

Weeds compete severely with field pea, particularly at the time of crop emergence, resulting in sharply reduced seed yield and lower quality. Costs associated with cleaning and transporting dockage decrease prices paid to the producer. Therefore, an effective weed control program is essential and often the most important consideration for profitable field pea production. An integrated approach to weed control combines preventative and cultural measures (such as clean seed and appropriate tillage) with effective use of selective chemicals. Weed control during summerfallow years (particularly for perennials), fall spraying for winter annuals and selection of a field where anticipated weed problems can be controlled by products registered for use in field pea are important points to note when planning field pea production. No new weeds should be introduced with the seed, and effective weed control must be obtained during the cropping season so that the pea fields will remain suitable for subsequent cropping. Avoid areas where perennial weeds may be a

problem.

A. Cultural Weed Control

Harrowing between seeding and emergence of the pea crop can control newly emerged weed seedlings and removal of weeds which escaped previous tillage operations. Harrowing should be avoided as the crop plants emerge and for several days after emergence to permit effective rooting and stand establishment. Postemergence harrowing must be viewed as a **drastic** measure. However, once the pea plants have reached the 4- to 6-leaf stage an additional operation, preferably using a finger weeder or flexible harrow, may provide a limited degree of control of germinating annual broadleaf weeds. Weed control from postemergence harrowing is often erratic, and crop damage may cause variable maturity. The best weed control will be obtained by harrowing on a dry, warm, sunny day. Harrowing should be avoided during damp, cool weather or during a heavy dew to prevent the spread of diseases. Harrowing may also be required to break crusted surfaces in clay soils.

B. Chemical Weed Control

Chemical weed control usually provides effective and consistent results. The advantages from fall application of soil-incorporated herbicides include more uniform distribution of the active materials for improved weed control and crop tolerance, conservation of soil moisture by reduction of spring tillage operations, the potential for earlier seeding, and more efficient timing of labor inputs for herbicide application and incorporation. The primary disadvantage of fall application of soil- incorporated herbicides is increased susceptibility of the treated fields to soil erosion due to reduction of crop residues and loosening of the soil surface. Granular formulations are recommended for fall application into stubble, as liquid formulations may be bound by the crop residues, resulting in reduced weed control.

For postemergence products, operations with a field sprayer should be conducted before the pea vines reach the 5-node stage to minimize mechanical damage. In addition, weeds are generally more susceptible and field pea plants more tolerant to herbicides applied an early.

Careful planning of rotations will permit a balanced attack on the weeds. The different products available for use in pea and cereal crops can complement each other, thereby controlling a wide spectrum of weeds and ensuring that no weed species goes unchecked for more than a single season. Fields treated with the commercial mixture of picloram plus 2,4-D (TORDON 202C) should **NOT** be seeded to grain legumes for at least 5 years after application of picloram. Carryover of picloram may necessitate seeding an indicator area with pea 1 year prior to intended commercial cropping as a test for residual activity. Symptoms of picloram injury include an upward cupping of the leaves, reduced growth and failure of the plants to pod and set seed.

Crop damage can also occur when aras previously treated with GLEAN, ALLY or ASSERT are seeded to dry pea. Follow label re-cropping restrictions when growing dry peas after use of any of these products. Areas of dense perennial weed growth should be avoided or controlled with spot treatments of non-selective herbicides such as glyphosate (ROUND-UP) where the crop is sacrificed to control patches of thistle or quackgrass. Roundup can also be used as a pre-harvest treatment to control these perennial weeds. A height differential between pea seedlings and taller weeds permits selective application of herbicides through a rope wick applicator. Fall application of a phenoxy will control winter annual weeds.

Several herbicides which effectively control most of the common weed species are registered for use in field pea crops. Frequently, a combination of herbicides will be required to provide the desired control of both grass and broadleaf weeds during the cropping season. Precautions should always be taken to carefully read and exactly follow the label recommendations for each herbicide, as these may differ from the more familiar applications in cereals and oilseeds.

The following herbicides are registered for use in field pea crops in Western Canada.

- ADVANCE®
- AVADEX®
- BASAGRAN®
- BONANZA®
- EDGE®
- FUSION®
- HOE-GRASS®
- LEXONE®

- MCPA (Amine and Sodium Salt)
- ODYSSEY®
- POAST®
- PURSUIT®
- RIVAL®
- SELECT®
- SENCOR®
- TCA
- TREFLAN®
- TROPOTOX®PLUS
- VENTURE®

Use of non-registered compounds is not advised. Field pea producers may obtain information on the current status of herbicide recommendations and weed control procedures by contacting the Crop Development Centre, University of Saskatchewan, Saskatoon, staff of Saskatchewan Agriculture and Food or by reviewing the annual publication "Chemical Weed Control in Field and Forage Crops."

C. Crop Dessication

Desiccation may be used on dry green peas to reduce bleaching of desirable green colour. Desiccation of yellow or green peas also reduces the period of time from maturity to harvest and eliminates the need for swathing to dry green weeds which interfere with harvesting. Apply Reglone when the crop has reached maturity, as this treatment does not mature the pea seed.

Ground Application:

Apply 0.6 L/ac of Reglone in light stands free of weeds and 0.8 L/ac in heavy stands or where green weeds are present. Use 90 - 220 L of water /ac and a sprayer pressure of 200-300 kPa.

Aerial Application:

Apply 0.6 L/ac of Reglone in sparse, non-uniform stands, 0.8 L/ac in normal stands and 1.1 L/ac in heavy stands or where green weeds are present. Use at least 18 L of water/ac and a pressure of 150 - 200 kPa.

Use Agral 90 (a wetting and spreading agent) at 0.1% v/v (1 L/1000 L water) for all applications to provide more uniform coverage and desiccation.

Avoid spray drift onto adjacent crops and tree rows. Germination of seed is not affected.

Pre-harvest application of ROUNDUP for perennial weed control will also provide some crop dry-down benefits. Apply 1.0 L/acre of 20 L of water/ac when the crop has 30% or less grain moisture (75-80% of pods are brown). Spray pressure should be no more than 275 kPa. Do not apply by aircraft.

CAUTION - Always read and follow label instructions when using herbicides and desiccants

Table of Contents

Insect Pests

Pea aphid - The adult is small - about 4 mm (3/16 in.) long - light- green and long-legged. The insect may be wingless or have prominent, nearly transparent wings. There are two sources of pea aphids in Saskatchewan. Although pea aphids rarely survive winer in Saskatchewan, they may overwinter as a egg attached to the stems or leaves of alfalfa or clover. In early spring the eggs hatch. The young aphids feed on the newly emerged alfalfa or clover plants. During May and June, depending on weather and host plant conditions, the insects develop wings and fly, with the aid of wind currents, to the pea fields. The majority of aphids in pea fields are blown in on warm southerly winds from the United States in June or early July. The pea aphid weakens the plant directly by sucking its sap and can transmit virus diseases from one pea plant to another in the process. It is difficult to determine whether the crop should be sprayed for aphids. A

heavy shower or strong wind will often cause the insects to disappear. An insecticide application may be indicated if there are more than 10 aphids on a plant during the period between formation of the 10th node and appearance of the first flower. Population estimates should be calculated by averaging the counts taken from at least five separate areas of the field. To avoid reoccurence o the problem ater spraying, delay applicaiton of insecticide until late flowering. One application per season should give satisfactory control. Pea aphic populations usually decrease drastically in mide to late August due to natural mortality factors, including parasitic wasps and disease. For information on registered insecticides in dry pea, review the publication "Insect Control in Field Crops" available from Saskatchewan Agriculture and Food.

Disease Prevention

Dry pea crops are subject to a number of plant diseases that can reduce yield and quality. Infection can arise from a variety of sources. Seed-borne soil-borne and residue-borne diseases can be minimized through preventative management. For these diseases, the following precautions can prove useful:

1. Seed early.
2. Practice effective crop rotation.
3. Use the best seed available.
4. Choose a well-drained field.
5. Use a registered seed treatment fungicide.

Common Diseases

Mycosphaerella blight - This fungal disease is also known as ascochyta blight. There are three distinct species of *Ascochyta* that infect dry pea, however, in Saskatchewan one species is the most common - *Ascochyta pinodes*. This species has a known sexual stage, given the name *Mycosphaerella*. Fungi with a sexual stage can spread farther from infected crop residue. Infection can be caused by inoculum that originates in adjacent or neighbouring fields. Thus crop rotation is not a guarantee against infection.

Mycosphaerella blight is characterized by purplish-black, irregularly-shaped spots on leaves, stems and pods. Its impact on yield depends primarily on the timing of initial infection. If the source of the infection originates within the same field, the disease can develop early and the likelihood of loss is greater. It is unwise to grow dry pea in a field more than once in four years.

Seed infection is an important source in introducing *Mycosphaerella* to an area. However, seed transmission of mucosphaerella blight is of less significance than transmission from infected pea stubble. No registered varieties are resistant to mycosphaerella blight.

Sclerotinia stem rot - This disease attacks many broadleaf crops, but is most severe on sunflower, dry bean and canola. It overwinters as sclerotia - small black resting bodies - in the soil, apart from the host. Sclerotia may remain viable for up to three years.

Infection can take place in two ways. Firstly, when in close contact with the pea root, sclerotia may germinate and caue infection at the base of the plant. Secondly, under a dense plant canopy, sclerotia will germinate adn develop tiny mushroom-like structures that produce spores. These spores can only cause infection by first colonizing dead plant material such as fallen flower petals or hail-damaged leaves. Spores can be windblown, so planting dry pea next to previously infected fields can assist in spreading the disease.

Once infection has occured, it can spread very quickly by plant-to-plant contact, especially when there is free moisture on lodged plants. Production of short-vined and semi-leafless varieties has resulted in delayed lodging. This delays the onset of infection of the pea plant and reduces yield loss due to sclerotinia infection. If infection occurs late in the growing season, there may be little effect on yield, however, the build up of sclerotia in a field may jeopardize subsequent crops. There are no fungicides registered for the control of stem rot in field pea.

Root Rot - Root rotting fungi can attack any part of the root system, sometimes even a short distance above the soil surface. When young seedlings are infected with root rot they usually die. Infected plants may appear yellowed and stunted. Seed treatment offers some protection to the developing seedling, especially under cool, wet conditions when emergence may be delayed. Crop rotation is also useful in preventing the build up of root rot organisms in the soil. Low-lying areas favour the development of root rot so a well-drained field is advantageous.

Bacterial blight - This disease is primarily seed-borne so obtaining seed free of bacterial blight is important. The

bacteria can also overwinter on crop residues, so crop rotation is an important method of disease control. Symptoms start as small water-soaked spots on leaves, stems and pods. During wet weather, a creamy white exudate may appear on the spots. When this material dries, the spots take on an olive-brown colour and occasionally a shiny appearance. If an infected leaf is held up to the light these leaf spots appear translucent. The bacteria is spread by rain splash. Hail or other physical injury to the plant may favour the spread of infection.

Powdery mildew - This fungal disease is favoured by periods of warm, dry, daytime conditions when nights are cool enough to cause dew formation. Rain showers are actually disruptive to the spread of powdery mildew.

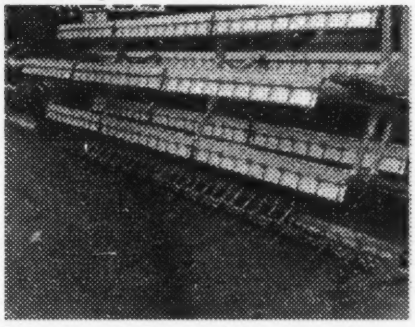
The disease first appears as white, powdery spots that may quickly cover the entire plant. In severe infestations brown, pitted spots may occur on pods and the seed may be visibly affected as well. Premature ripening may result in shrunken seed.

A foliar fungicide (sulphur) is registered for control of powdery mildew. It should only be necessary to use fungicide when the disease appears early in the growing season. Early seeding is beneficial since powdery mildew infection is more damaging on late-maturing pea crops. Two yellow-seeded food type varieties, AC Tamor and Highlight, and the feed type variety Tara are resistant to powdery mildew.

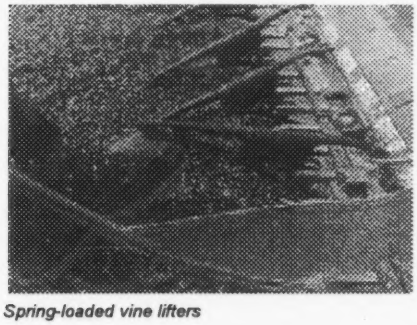
Other Diseases - Other fungal disease of minor importance to dry pea include downy mildew, anthracnose, septoria blight and rust. A few virus diseases also occur in dry pea. They are spread by feeding aphids with the exception of one; pea seed-borne mosaic virus (PSbMC).

Table of Contents

Harvesting



Pickup reel, with fingers and vine lifters. This assembly can be adapted to either combine or swather.



Spring-loaded vine lifters

Extreme care should be taken in harvesting the crop. Pea samples that have been harvested in a careless manner and contain excessive amounts of foreign material, cracked seed coats, and broken and damaged seeds will have heavy losses in the cleaning process.

Field pea plants may be swathed prior to full maturity (wind is a hazard), or straight-combined at full maturity. The swather can also be used if cutting is delayed until the crop has reached full maturity. The combine should follow immediately behind the swather; danger of swath damage by strong winds in a mature crop will thereby be avoided. The swather should be equipped with vine lifters (pic-up guards) and possibly a pick-up reel *(see illustrations)*.

When the pea crop is straight-combined, the following method is used. The vines are permitted to ripen on the ground; after reaching full maturity they can be successfully harvested, provided the combine is equipped with a floating cutter bar, a pick-up reel, and vine lifters are attached to the sickle guards.

An alternative method invloves the user o a Rake Up or Sund pick-up at full maturity. These pick-ups have a positive action and break the ripe vines off at the soil surface, eliminating the need to swath.

Since the pea seeds shell very easily when dry, they should be harvested during the humid part of the day, and action of the reels against the crop should be kept to a minimum. Very low cylinder speeds are required to reduce seed splitting. Cylinder speeds of 350 to 600 r.p.,m. are normally used, depending on cylinder diameter and the moisture content of the peas. An initial concave setting of 1 1/2 cm clearance at the front and 1/2 cm at the rear is recommended. Combine augers and grain loaders should be operated at low speeds to reduce cracked, split, and broken seeds.

Pea seeds containing green weed seeds or other foreign materials high in moisture content should be cleaned as soon as possible to prevent heating. The pea crop can be combined at 16 to 20 percent moisture to keep splitting and shattering losses low and then air dried for storage. Moisture levels up to 16 percent are considered safe for the field pea. If drying is necessary a maximum air temperature of 43° C should be used for pea seed harvested for seed purposes and 71° C for pea seed harvested for commercial use.

Table of Contents

Additional Information Sources

Legume Inoculation
Saskatchewan Agriculture and Food (fact-sheet)

Chemical Weed Control in Cereal, Oilseed, Pulse and Forage Crops
Saskatchewan Agriculture and Food (annual)

Guidelines for safe rates of fertilizer applied with seed
Saskatchewan Agriculture and Food (fact-sheet)

Insect Control in Field Crops
Saskatchewan Agriculture and Food (annual)

Pea Varieties for Saskatchewan
Saskatchewan Agriculture and Food and Saskatchewan Rural Development (fact-sheet)

Varieties of Grain Crops for Saskatchewan
Agriculture Development Fund

Alternative Crop Planning Guide
Saskatchewan Agriculture and Food (fact-sheet)

Saskatchewan Special Crop Market and Contract Synopsis
Saskatchewan Agriculture and Food (fact-sheet).

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Page Accessed: 703 times
Navigation Path >> Home | Crops | Pulses | Production Information |

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